

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-146830  
 (43)Date of publication of application : 21.05.2003

(51)Int.CI. A61K 7/00  
 // A61K 7/06  
 A61K 7/48

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## (54) COSMETIC

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a cosmetic which is obtained by processing a single kind of a polyamino acid, develops both actions of moisture retaining property and elasticity, has a simple component composition and a reasonable cost.

**SOLUTION:** This cosmetic comprises a radiation-crosslinked body of a polyamino acid or a polyamino acid salt. In the cosmetic, especially the polyamino acid is  $\gamma$ -polyglutamic acid and the polyamino acid salt is  $\gamma$ -polyglutamate. Since a great number of bag-like internal spaces are formed in the network structure by radiation crosslinking and a large amount of water can be absorbed and held in the internal spaces, a revolutionary cosmetic which has extremely increased moisture retaining property and can provide the surface of the skin with elasticity can be actualized. Furthermore, since both moisture retaining property and elasticity are provided by radiation crosslinking of a single kind of the polyamino acid, an excellent cosmetic can inexpensively be obtained.

## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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<http://www19.ipdl.ncipi.go.jp/PA1/result/detail/main/wAAcasaWpZDA415146830...> 2005/03/28

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The charge of makeup characterized by blending polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt [claim 2] The charge of makeup according to claim 1 said whose polyamino acid is gamma-polyglutamic acid and said whose polyamino acid salt is gamma-polyglutamic acid salt.

[Claim 3] The aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt is a charge of makeup according to claim 2 which is the production object of gamma-polyglutamic acid production bacillus.

[Claim 4] The charge of makeup according to claim 2 in which the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt has 10 million or more molecular weight.

[Claim 5] The charge of makeup according to claim 2 whose loadings of the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt are 0.01 - 10 % of the weight.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention blends the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt especially with a detail, makes it discover a moisturization operation and an elasticity operation to the skin or hair about the charge of makeup which blended polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt further, and relates to the charge of makeup which demonstrates a beautiful skin effect and the beautiful hair effectiveness.

**[0002]**

**[Description of the Prior Art]** Generally, in order to hold the skin and hair youthfully, it is thought important to make the skin and hair moisturize moisture. In the horny layer of the skin, the moisture absorption matter called NMF (Natural Moisturing Factor: natural moisturization factor) exists originally, and this NMF is performing the moisturization operation of the skin. Similarly the hairy-cells film complex called CMC (Cell Membrane Complex) also to hair between cuticles exists, and the condition of hair is prepared. Moreover, the sebum as a natural emollient component controlled the moisture evaporation from epidermis, and has strengthened the operation of said natural moisturizer.

**[0003]** Therefore, charges of makeup, such as cosmetics for the skins and cosmetics for hair, use these natural moisturization devices as a model, and are designed. That is, in the charge of makeup, the role with big moisturizer for which the moisture of epidermis or a horny layer is made to suspend and emollient agent which controls evaporation of the moisture of a horny layer is played.

**[0004]** As a moisturizer used conventionally, chemosynthesis matter, such as natural materials, such as a glycerol, and hyaluronate, a chondroitin sulfate of a sorbitol and a dermis component, a polyethylene glycol, and a polypropylene glycol, was blended by several % – dozens of% of daily dose.

**[0005]** Moreover, the oil which has the presentation near sebum as an emollient agent is used, or lanolin, a squalane, lecithin composition ester, etc. have been used as fats and oils with water holding.

**[0006]**

**[Problem(s) to be Solved by the Invention]** However, recent years come and the ED which uses amino acid as a moisturizing component of cosmetics is progressing. Amino acid is the component of the protein which constitutes the body, and is a component with very good and safe affinity with the skin or hair.

**[0007]** For example, when the cell of epidermis dies and it becomes a horny layer, intracellular protein decomposes, it becomes amino acid, and it came to be known that this amino acid will function as a moisturization factor of a horny layer. Moreover, it has also turned out that amino acid is acting as a moisturizing component of the cuticle of hair.

**[0008]** Then, the charge of makeup which blended amino acid came to be developed. JP,8-217656,A is indicating the charge of makeup containing saccharide joint polyamino acid. JP,10-298058,A is indicating the baths containing polyacid nature amino acid. These perceive the

moistness of polyamino acid and aim at the moisturizing effect and the surface deterioration prevention effectiveness of the skin, or skin smooth effectiveness.

[0009] Moreover, JP,2001-34217,A indicates the skin external preparations which blended the amino acid and fermented-soybeans extractives more than a kind, and JP,2000-34219,A is indicating the skin external preparations which blended the mucopolysaccharide and fermented-soybeans extractives more than a kind. In addition to a moisturization operation of amino acid or a mucopolysaccharide, these invention adds the resiliency of fermented-soybeans extractives.

[0010] Fermented-soybeans extractives are the liquid which carried out the ethanol extract of the viscous component of fermented soybeans, and are natural extractives which use gamma-polyglutamic acid as a principal component. Although glutamic acid is also a kind of amino acid, there is a property of giving a feeling of elasticity to the skin by the viscosity nature, and since it is moreover a natural component, it is a very safe charge of makeup.

[0011] Thus, the latest charge of makeup has introduced both a moisturizing effect and the elasticity effectiveness into the charge of makeup by using polyamino acid and gamma-polyglutamic acid together.

[0012] However, since gamma-polyglutamic acid is a kind of polyamino acid, the conventional charge of makeup which uses together polyamino acid and fermented-soybeans extractives will blend two or more sorts of polyamino acid, and will give both operations of moistness and resiliency to the skin and hair. If the class of polyamino acid is different, it can be understood that the properties also differ, but blending two or more sorts of polyamino acid also becomes the factor which skyrockets a price at the same time it complicates the component of the charge of makeup.

[0013] Therefore, the purpose of this invention makes both operations of moistness and resiliency discover by processing the polyamino acid of a single kind, its component presentation is simple, and, moreover, a price is offering the handy charge of makeup.

[0014]

[Means for Solving the Problem] Invention of claim 1 is a charge of makeup characterized by blending polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt.

[0015] Invention of claim 2 is a charge of makeup according to claim 1 said whose polyamino acid is gamma-polyglutamic acid and said whose polyamino acid salt is gamma-polyglutamic acid salt.

[0016] Invention of claim 3 is a charge of makeup according to claim 2 the aforementioned gamma-polyglutamic acid or whose gamma-polyglutamic acid salt is the production object of gamma-polyglutamic acid production bacillus.

[0017] Invention of claim 4 is a charge of makeup according to claim 2 in which the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt has 10 million or more molecular weight.

[0018] Invention of claim 5 is a charge of makeup according to claim 2 whose loadings of the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt are 0.01 – 10 % of the weight.

[0019]

[Embodiment of the Invention] As a result of doing wholeheartedly research which gives resiliency like fermented-soybeans extractives to the polyamino acid which has moistness, this invention person used to discover that the radiation-induced crosslinking object acquired by carrying out radiation irradiation of polyamino acid or the polyamino acid salt gains resiliency, and used to complete this invention.

[0020] If radiation-induced crosslinking of gamma-polyglutamic acid or the gamma-polyglutamic acid salt is carried out especially, while moistness will increase rapidly also in polyamino acid as compared with bridge formation before, it discovers discovering free resiliency and the foundation of this invention is built.

[0021] Generally, the structure expression of amino acid is expressed with  $\text{NH}_2(\text{COOH})-\text{CH}-\text{R}$ . The heteropolymer the homopolymer and two or more sorts of amino acid the same amino acid carried out [ amino acid ] the polymerization to the shape of a chain carried out [ the heteropolymer ] the polymerization to the shape of a chain exists in polyamino acid. In order to

carry out hydrogen bond of the hydrogen atom H and the oxygen atom O in polyamino acid to water, polyamino acid has the moistness which adsorbs water on a front face. Therefore, it is also the reason the moistness of the polyamino acid which has safety is used as a charge of makeup.

[0022] If radiation irradiation of the polyamino acid which is this chain molecule is carried out, for example, CH<sub>2</sub> in polyamino acid becomes CH- by dehydrogenation, CH- of two polyamino acid will combine with CH-HC, and they will form a bridge formation object. If much polyamino acid constructs a bridge with a radiation, it will become the network structure and much saccate space will be formed in the interior. Of course, crosslinking reaction may arise also in paths other than dehydrogenation.

[0023] Since the bridge formation by the radiation can construct a bridge, without heating polyamino acid, it has the advantage which can form a polyamino acid radiation-induced crosslinking object, with the property of amino acid original left. A radiation-induced crosslinking reaction is low-temperature crosslinking reaction, and a different point from the crosslinking reaction by heating is the description. Although polyamino acid receives heat conversion with heating, in the radiation-induced crosslinking of this invention, it has the description at the point of not receiving heat conversion.

[0024] As mentioned above, since a polyamino acid radiation-induced crosslinking object has much saccate space inside, it has the capacity which carries out absorption preservation of the water molecule to this saccate space, and can discover bigger water retention ability than polyamino acid according to this operation. It not only raises the moisturization engine performance as a cosmetics material much more, but this water retention ability has the description which makes the skin and a hair front face discover resiliency by water retention to saccate space. Thus, by carrying out radiation-induced crosslinking of the polyamino acid, it became possible to possess increase-izing of moistness, and both of resiliency to coincidence.

[0025] Next, gamma-polyglutamic acid is explained in order to materialize the above description more. gamma-polyglutamic acid is the chain molecule expressed with n (-NH(COOH) CH-CH<sub>2</sub>-CH<sub>2</sub>-CO-), and Subscript n gives polymerization degree. The thing which has big molecular weight, especially the thing which has hundreds of thousands - millions of molecular weight are suitable for gamma-polyglutamic acid used as a start raw material, and such molecular weight is decided by said polymerization degree n.

[0026] That by which gamma-polyglutamic acid concerning this invention was produced by the various manufacture approaches is used. As a process, there are the culture approach by the microorganism, a chemosynthesis method, etc., for example. gamma-polyglutamic acid produced by the microorganism is the quality of a natural product, and is recommended from a viewpoint of safety.

[0027] In microorganism cultivation, although bacilli, such as *Bacillus subtilis* of *Bacillus*, *bacillus anthra cis-\*\* bacillus megger TERIUMU*, and *Bacillus natto*, can be used, F-two to 01 shares of *Bacillus subtilis* are especially suitable in a volume. Molecular weight produces gamma-polyglutamic acid of hundreds of thousands - a-1 million number, and since that molecular weight is comparatively large, this strain can manufacture a bridge formation object efficiently with a radiation.

[0028] gamma-polyglutamic acid which a microorganism produces is eaten more as a principal component of the glutinous substance of fermented soybeans in ancient times -- as -- men and beasts -- it is a harmless natural product and has the big description of having biodegradability. That is, even if this gamma-polyglutamic acid not only has biodegradability, but it eats it accidentally, it is harmless, and it excels in the point of becoming a nutrient conversely. Therefore, it can be called a very safe cosmetics material, without hurting the skin and one's hair, even if used as a charge of makeup.

[0029] gamma-polyglutamic acid which said microorganism produces is gamma-peptide of the shape of a straight chain without ramification, and is the copolymer of L-glutamic acid and D-glutamic acid, i.e., a heteropolymer. gamma-polyglutamic acid of this heteropolymer structure is the optimal thing which can be used for this invention.

[0030] gamma-polyglutamic acid of microorganism production carries out seeding of the

microorganism to the liquid medium which mixed necessary nutrient, carries out duration culture at necessary temperature, isolates gamma-polyglutamic acid and is obtained from culture medium. A solid medium may be used in addition to a liquid medium. In this invention, the culture containing gamma-polyglutamic acid which was settled not only from gamma-polyglutamic acid simple substance but from the culture medium itself and culture medium, and was obtained is sufficient.

[0031] The polymer of various structures, such as mixture of the homopolymer of L-glutamic acid, the homopolymer of D-glutamic acid, and both [these] homopolymers, is generated by gamma-polyglutamic acid by which chemosynthesis is carried out. These gamma-polyglutamic acid by which chemosynthesis was carried out can also be used in this invention.

[0032] Moreover, gamma-polyglutamic acid salt used by this invention is generated by neutralization of gamma-polyglutamic acid and a basic compound as a salt. If it stirs making it dissolve in solvents, such as water, at a room temperature, and heating gamma-polyglutamic acid and a basic compound, it will be generated efficiently. As a basic compound, the hydroxide of alkali metal or alkaline earth metal, for example, a sodium hydroxide, a potassium hydroxide, a magnesium hydroxide, a calcium hydroxide, a barium hydroxide, etc. have the basic compound of organic nature, such as ammonia and an amine.

[0033] In the reaction condition of gamma-polyglutamic acid and a basic compound, whenever [stoving temperature] has desirable 5-100 degrees C. If a reaction becomes slow and exceeds 100 degrees C, the water which is a kind of a solvent may boil below 5 degrees C, and a reaction may not be stabilized at them. Moreover, the range of pH of acescence - weak base nature is desirable, and especially pH has the desirable range of 5-10. Moreover, stoichiometric reacting weight without excess and deficiency is suitable for the daily dose of gamma-polyglutamic acid and a basic compound.

[0034] That from which molecular weight is distributed over hundreds of thousands - a-1 million number is suitable for gamma-polyglutamic acid or gamma-polyglutamic acid salt used by this invention, and in being microorganism production, it distributes the molecular weight within the limits of it. What carried out the polymerization to hundreds of thousands or more also in the case of chemosynthesis is suitable.

[0035] In this invention, the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt is made to construct a bridge with a radiation, and molecular weight generates 10 million or more bridge formation objects.

[0036] If a radiation is irradiated at this gamma-polyglutamic acid, CH<sub>2</sub> becomes CH- by dehydrogenation, the straight chain of two gamma-polyglutamic acid joins together through CH-HC, and it is thought that a bridge is constructed like 2 (-NH(COOH) CH-CH-CH<sub>2</sub>-CO-). If this degree of cross linking becomes still larger, a radiation-induced crosslinking object with big molecular weight will be generated like [(-NH(COOH) CH-CH-CH<sub>2</sub>-CO-) n] m. Here, m shows a degree of cross linking and gives the number of the straight chain of gamma-polyglutamic acid by which bridge formation connection is carried out.

[0037] By enlarging a degree of cross linking m, molecular weight of gamma-polyglutamic acid radiation-induced crosslinking object is made or more into 10 million. Since gamma-polyglutamic acid is a polypeptide chain, the network structure by which much saccate space was formed in the interior of connection of -CH-HC- is formed.

[0038] This invention is discovered and made [having polyamino acid and the water-absorption-power force also in it in which the radiation-induced crosslinking object of gamma-polyglutamic acid is very big, and]. The water absorption reaches also about 1000 times, and it increases, so that it does not become as compared with the water absorption of gamma-polyglutamic acid in front of radiation irradiation. if increase-ization of this water absorption is put in another way -- the moisturization engine performance -- \*\*\*\* -- it is-izing and increase-ization of resiliency ability is brought to coincidence. It is again said to the absorptivity of gamma-polyglutamic acid being only the hydration on the front face of a molecule that the absorptivity of gamma-polyglutamic acid radiation-induced crosslinking object is water absorption to the internal saccate space by the network structure.

[0039] Since saccate space will become small if it passes over a degree of cross linking in slight

height, water holding capacity declines and moistness and resiliency also decline. Therefore, it becomes possible by adjusting a degree of cross linking appropriately to optimize moistness and resiliency.

[0040] Since the water holding capacity of the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt shuts up into water the particle of the makeup material which protects the skin, it can protect the skin and hair over a long period of time, and can make the manifestation period of the makeup effectiveness it not only to hold moisture, but extend.

[0041] Like the above-mentioned, it is the description to use a radiation for making gamma-polyglutamic acid construct a bridge in this invention. In making a bridge construct according to thermal reaction, an elevated temperature is needed and, for this reason, gamma-polyglutamic acid as a raw material or gamma-polyglutamic acid salt tends to receive thermal denaturation. If radiation-induced crosslinking is used, since a bridge can be constructed at low temperature, bridge formation can be realized without deteriorating gamma-polyglutamic acid. Therefore, gamma-polyglutamic acid bridge formation object which does not contain a denaturation object can be acquired by radiation-induced crosslinking.

[0042] Especially gamma-polyglutamic acid of microorganism production is a kind of a polypeptide, and it is difficult to adopt heating bridge formation, judging from the weak thermal one of amino acid. Considering that the viscous matter of fermented soybeans is gamma-polyglutamic acid, probably, the situation of the thermal denaturation at the time of heating fermented soybeans is known well. Therefore, in this invention, in order to realize low-temperature bridge formation, it has the description at the point of using radiation-induced crosslinking.

[0043] It can carry out radiation irradiation of the culture medium, the culture, etc. obtained by microbial cultivation, and it not only carries out radiation irradiation of the simple substance of gamma-polyglutamic acid or gamma-polyglutamic acid salt, but can acquire the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt.

[0044] As a radiation for bridge formation, alpha rays, beta rays, a gamma ray, an X-ray, an electron ray, a neutron beam, a meson line, an ionic line, etc. can be used. Also in this, a gamma ray, an X-ray, and an electron ray are suitable from good [ of operability ]. Both X-ray tube or non-bulb type can use an X-ray, and the synchrotron orbital radiation emitted from the electronic ring which has spread in recent years can also use it. An electron ray can use well-known electron-beam-irradiation equipment according to beam energy.

[0045] The gamma ray is excellent in the point that the radiation source can be used. Although there are the cobalt 60, a strontium 90, a zirconium 95, cesium 137, a cerium 141, and ruthenium 177 grade as a gamma ray source, the cobalt 60 from a viewpoint and cesium 137 of a half-life or energy are suitable.

[0046] In this invention, molecular weight generates 10 million or more gamma-polyglutamic acid radiation-induced crosslinking objects or gamma-polyglutamic acid salt radiation-induced crosslinking object by carrying out radiation-induced crosslinking of gamma-polyglutamic acid or the gamma-polyglutamic acid salt. If a bridge is constructed or more over 10 million in molecular weight, the absorptivity ability of gamma-polyglutamic acid bridge formation object will increase rapidly, and the moisturization engine performance and resiliency ability will improve as a charge of makeup.

[0047] In order to construct a bridge over 10 million or more molecular weight in gamma-polyglutamic acid or gamma-polyglutamic acid salt, the radiation irradiation of 1-500kGy is required for gamma-polyglutamic acid raw material at an absorbed dose, by 1 or less kGy, since bridge formation will advance too much if bridge formation does not advance easily and 500kG (ies) are exceeded, the building envelope formed of the network structure of a bridge formation object becomes small, and water absorbing power comes to decline conversely. As an absorbed dose from a viewpoint of cross-linking and absorptivity, 5-100kGy is still more suitable.

[0048] Generally, although gamma-polyglutamic acid salt is dissolved in water, it is known that gamma-polyglutamic acid is insolubility at water. However, when radiation-induced crosslinking was performed also to any of gamma-polyglutamic acid and gamma-polyglutamic acid salt, it was

discovered that reforming is carried out so that the front face of radiation-induced crosslinking object may have compatibility to water and water organic solvents, such as water alcohol and a water acetone.

[0049] This invention was also made paying attention to the property of the surface treatment of gamma-polyglutamic acid by radiation-induced crosslinking, and gamma-polyglutamic acid salt radiation-induced crosslinking object. That is, both gamma-polyglutamic acid and gamma-polyglutamic acid salt come to have a hydrophilic property by becoming a radiation-induced crosslinking object.

[0050] It means that gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object dissolve to a lot of [ this property ] water. However, the intermediate state to the dissolution also means absorbing water water and holding the gel state and a sol condition. According to the experiment of this invention person, with the water absorption over pure water, it turns out that it will shift to a sol condition if about 1000 times hold the gel state and the amount of pure water is made [ more ] than it, and it changes to a solution gradually. Therefore, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object have the capacity for a compounding ratio with water to be able to adjust the material gestalt of cosmetics free.

[0051] gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object also have alcoholic content capacity by the hydrophilic property, for example, if added by 0 – 50% of native alcoholic water solution, it can mix with equalization and they can be gelled.

[0052] Moreover, it can mix with gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object with many hydrophilic matter underwater. For example, it can mix and gel to the water solution and homogeneity of 0 – 50% of glycerol, butanediol, or polyethyleneimine.

[0053] Furthermore, it can mix with gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object with many hydrophobic matter in an alcoholic water solution. For example, it can mix and gel in the diol mold 700 and the diol mold 3000 of a polypropylene glycol to the water solution and homogeneity which added alcohol: The same property also as a liquid paraffin is shown.

[0054] Therefore, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object can mix with other charge materials of makeup and homogeneity which were chosen appropriately, and can form the charge of makeup made into the purpose. It can follow, for example, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object can be used as a material of various kinds of cosmetics, such as makeup products, such as hair treatment products, such as skin care products, such as a milky lotion and an essence, and hair rinse hair treatment, and foundation, and a lip stick.

[0055] Although 0.01 – 10% of the weight of the range is suitable for the loadings of gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object, since they differ according to the cosmetics made into the purpose, they are not limited to this numeric value.

[0056] The property of gamma-polyglutamic acid mentioned above and gamma-polyglutamic acid salt radiation-induced crosslinking object is applicable also like the polyamino acid as a charge of makeup and the polyamino acid salt radiation-induced crosslinking object which are a superordinate concept.

[0057]

[Example] As a [manufacture of radiation bridge formation object of example 1:gamma-polyglutamic acid] gamma-polyglutamic acid production bacillus, *Bacillus subtilis* F-2-01 was chosen. In order to mass-produce, the liquid medium has been arranged in the container of 3 several 100m. The medium composition was constituted as follows.

グルコース	0. 5重量%
L-グルタミン酸	8. 0重量%
ペプトン	0. 7重量%
ウレア	0. 68重量%
NaNO <sub>3</sub>	0. 5重量%
KH <sub>2</sub> PO <sub>4</sub>	0. 24重量%
精製水	残量

[0058] the inside of this liquid medium — said strain — inoculation — carrying out — pH — 7.5 — adjusting — a top — 37-degree C constant temperature — it held in the condition. If culture is continued for six days, carrying out aeration stirring, gamma-polyglutamic acid and its salts will be accumulated into culture medium. Centrifugal separation of the culture medium was carried out, the fungus body was separated from culture medium, and the aforementioned gamma-polyglutamic acid was isolated further.

[0059] Although it depended for the volume of gamma-polyglutamic acid also on the culture condition, it turned out that it reaches into culture medium 5-50 (g/L), and it was proved that industrial mass production method of gamma-polyglutamic acid is possible. Moreover, it turned out that the molecular weight of produced gamma-polyglutamic acid is distributed over 500,000-2 million. Here, an acid, salts, or those mixture are named gamma-polyglutamic acid generically.

[0060] 20kG(ies) (2Mrad) exposure of the gamma ray was carried out according to the cobalt 60 line source at the 5-% of the weight water solution of these gamma-polyglutamic acid, and gamma-polyglutamic acid radiation-induced crosslinking object was generated. The water solution was gelled by this radiation irradiation, and the molecular weight of gamma-polyglutamic acid radiation-induced crosslinking object was presumed to be about 15 million. this gel matter — dehydrating — gamma-polyglutamic acid radiation-induced crosslinking object — \*\*\*\*\* . This powder was white. Said gel matter and desiccation powder can be used as the charge raw material of makeup of this invention. This desiccation powder was used for all future examples.

[0061] [example 2: The amount of gelation] radiation irradiation of the water solution of polypropylene 700 obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with polypropylene 700, and polypropylene 700 was gelled. A result is shown in Table 1.

[0062]

<表1> PGA 1 %を添加したゲル (単位は重量部)

<ドリップビン量>	<純水>	<ゲル化状況>
2 0	8 0	不透明均一ゲル
3 0	7 0	不透明均一ゲル
4 0	6 0	不均一ゲル
5 0	5 0	不均一ゲル

[0063] As shown in Table 1, when the amount of polypropylene became large, it was hard coming to dissolve and uneven gel was done. However, when the amount of polypropylene became small, it turned out that it becomes opaque gel although equalization is carried out, and it is not dissolving completely.

[0064] [example 3: Ethyl alcohol was added in the water solution of the gelation] example 2 of the alcoholic water solution of polypropylene 700, and gelation was tried. The amount of radiation irradiation obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, ethyl alcohol was mixed with polypropylene 700 and pure water, and polypropylene 700 was gelled. A result is shown in Table 2.

[0065]

Gel which added <Table 2> PGA1% (a unit is the weight section)

The <amount of polypropylene> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 50

Transparency homogeneity gel 30 70 50 Transparency homogeneity gel 40 60 50 Transparency homogeneity gel 50 50 50 Transparency homogeneity gel [0066] As shown in Table 2, when only 50 weight sections added ethyl alcohol, regardless of the size of the amount of polypropylene, it dissolved in homogeneity and transparent homogeneity gel was obtained. Therefore, it turned out that the gelation by PGA improves greatly by adding alcohol.

[0067] [example 4: The amount of gelation] radiation irradiation of the water solution of polypropylene 3000 obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with polypropylene 3000, and polypropylene 3000 was gelled. A result is shown in Table 3.

[0068]

<表3> PGA 1 %を添加したゲル (単位は重量部)

<ポリプロピレン量>	<純水>	<ゲル化状況>
2 0	8 0	不均一ゲル
3 0	7 0	不均一ゲル
4 0	6 0	不均一ゲル
5 0	5 0	不均一ゲル

[0069] As shown in Table 3, polypropylene 3000 was not mixed with water regardless of the size of the amount, but even if gelled, it was able to do only uneven gel. However, as for some, compatibility was accepted.

[0070] [example 5: Ethyl alcohol was added in the water solution of the gelation] example 4 of the alcoholic water solution of polypropylene 3000, and gelation was tried. The amount of radiation irradiation obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, ethyl alcohol was mixed with polypropylene 300 and pure water, and polypropylene 3000 was gelled. A result is shown in Table 4.

[0071]

Gel which added <Table 4> PGA1% (a unit is the weight section)

The <amount of polypropylene> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 40 Opaque gel 30 70 40 Opaque gel 40 60 40 Opaque gel 50 50 40 Opaque gel [0072] As shown in Table 4, when only 40 weight sections added ethyl alcohol, regardless of the size of the amount of polypropylene, compatibility came to be looked at by the whole and opaque gel was obtained. When alcohol was added in the water solution, some improvements were realizable, but when homogenizing this further, it also turned out that a uniform sol can be created.

[0073] [example 6: The amount of gelation] radiation irradiation of the water solution of a liquid paraffin obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with the liquid paraffin, and the liquid paraffin was gelled. A result is shown in Table 5.

[0074]

<表5> PGA 1 %を添加したゲル (単位は重量部)

<流動パラフィン量>	<純水>	<ゲル化状況>
2 0	8 0	ゲルとパラフィンは分離
3 0	7 0	ゲルとパラフィンは分離
4 0	6 0	ゲルとパラフィンは分離
5 0	5 0	ゲルとパラフィンは分離

[0075] As shown in Table 5, the liquid paraffin was not mixed with water but the liquid paraffin also separated completely the gel generated by addition of PGA. Therefore, gelation of a liquid paraffin was not completed.

[0076] [example 7: The amount of gelation] radiation irradiation of the alcoholic water solution of a liquid paraffin obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, the ethyl alcohol 50 weight

section was mixed with liquid paraffin and pure water, and the liquid paraffin was gelled. A result is shown in Table 6.

[0077]

Gel which added <Table 6> PGA1% (a unit is the weight section)

The <amount of liquid paraffins> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 50 Affinitive ununiformity gel 30 70 50 Affinitive ununiformity gel 40 60 50 Affinitive ununiformity gel 50 50 50 Affinitive ununiformity gel [0078] If ethyl alcohol is added as shown in Table 6, although a liquid paraffin and water are uneven, it will mix and gel. In other words, it turned out that paraffin and ununiformity gel with compatibility are done. Therefore, where alcohol is added, when gelling by PGA, it turned out that more effective gelation can be attained.

[0079] The homogeneity gel in which the charge component of makeup carried out the distributed dissolution at homogeneity can be formed by blending the radiation-induced crosslinking object of gamma-polyglutamic acid concerning this invention, or gamma-polyglutamic acid salt with a water solution or a fortification-of-alcohol water solution with other charge components of makeup so that the above example may show. Therefore, it can use as a middle article which can use this homogeneity gel or sol as cosmetics, and results in cosmetics.

[0080] The charge of makeup concerning this invention is not limited to the above-mentioned operation gestalt and the above-mentioned example, and it does not have that it is what includes the various modifications in the range which does not deviate from the technical thought of this invention, a design change, etc. within the technical limits also until it says.

[0081]

[Effect of the Invention] according to invention of claim 1, since polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt is blended as a charge of makeup, in order to be made from the component of our body, it is very safe, and since water absorbing power is markedly alike and is moreover reinforced by radiation-induced crosslinking, extremely excellent moistness and resiliency can be discovered and the epoch-making charge for the skins of makeup and the charge for hair of makeup can be offered.

[0082] According to invention of claim 2, since the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt is used as a charge of makeup, any radiation-induced crosslinking object discovers a hydrophilic property, and since uniform gelation or uniform solating becomes possible even for the hydrophobic matter where especially alcohol is added, the cosmetics using various kinds of charge materials of makeup can be manufactured.

[0083] According to invention of claim 3, since gamma-polyglutamic acid or gamma-polyglutamic acid salt which gamma-polyglutamic acid production bacillus produced is used, even if human being consists of a raw material very safe as a natural material and eats by mistake, the very safe charge of makeup can be manufactured.

[0084] according to invention of claim 4, since molecular weight uses as a principal component the radiation-induced crosslinking object of gamma-polyglutamic acid which is 10 million or more, or gamma-polyglutamic acid salt, water capacity is markedly alike, becomes large, and can manufacture the charge of makeup which boiled moistness and resiliency markedly and reinforced them.

[0085] According to invention of claim 5, even if the loadings of the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt are very as little as 0.01 – 10 % of the weight, the charge of makeup holding stable gel or a sol condition can be offered.

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**TECHNICAL FIELD**

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[Field of the Invention] This invention blends the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt especially with a detail, makes it discover a moisturization operation and an elasticity operation to the skin or hair about the charge of makeup which blended polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt further, and relates to the charge of makeup which demonstrates a beautiful skin effect and the beautiful hair effectiveness.

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**PRIOR ART**

[Description of the Prior Art] Generally, in order to hold the skin and hair youthfully, it is thought important to make the skin and hair moisturize moisture. In the horny layer of the skin, the moisture absorption matter called NMF (Natural Moisturing Factor: natural moisturization factor) exists originally, and this NMF is performing the moisturization operation of the skin. Similarly the hairy-cells film complex called CMC (Cell Membrane Complex) also to hair between cuticles exists, and the condition of hair is prepared. Moreover, the sebum as a natural emollient component controlled the moisture evaporation from epidermis, and has strengthened the operation of said natural moisturizer.

[0003] Therefore, charges of makeup, such as cosmetics for the skins and cosmetics for hair, use these natural moisturization devices as a model, and are designed. That is, in the charge of makeup, the role with big moisturizer for which the moisture of epidermis or a horny layer is made to suspend and emollient agent which controls evaporation of the moisture of a horny layer is played.

[0004] As a moisturizer used conventionally, chemosynthesis matter, such as natural materials, such as a glycerol, and hyaluronate, a chondroitin sulfate of a sorbitol and a dermis component, a polyethylene glycol, and a polypropylene glycol, was blended by several % – dozens of% of daily dose.

[0005] Moreover, the oil which has the presentation near sebum as an emollient agent is used, or lanolin, a squalane, lecithin composition ester, etc. have been used as fats and oils with water holding.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] according to invention of claim 1, since polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt is blended as a charge of makeup, in order to be made from the component of our body, it is very safe, and since water absorbing power is markedly alike and is moreover reinforced by radiation-induced crosslinking, extremely excellent moistness and resiliency can be discovered and the epoch-making charge for the skins of makeup and the charge for hair of makeup can be offered.

[0082] According to invention of claim 2, since the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt is used as a charge of makeup; any radiation-induced crosslinking object discovers a hydrophilic property, and since uniform gelation or uniform solating becomes possible even for the hydrophobic matter where especially alcohol is added, the cosmetics using various kinds of charge materials of makeup can be manufactured.

[0083] According to invention of claim 3, since gamma-polyglutamic acid or gamma-polyglutamic acid salt which gamma-polyglutamic acid production bacillus produced is used, even if human being consists of a raw material very safe as a natural material and eats by mistake, the very safe charge of makeup can be manufactured.

[0084] according to invention of claim 4, since molecular weight uses as a principal component the radiation-induced crosslinking object of gamma-polyglutamic acid which is 10 million or more, or gamma-polyglutamic acid salt, water capacity is markedly alike, becomes large, and can manufacture the charge of makeup which boiled moistness and resiliency markedly and reinforced them.

[0085] According to invention of claim 5, even if the loadings of the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt are very as little as 0.01 - 10 % of the weight, the charge of makeup holding stable gel or a sol condition can be offered.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, recent years come and the ED which uses amino acid as a moisturizing component of cosmetics is progressing. Amino acid is the component of the protein which constitutes the body, and is a component with very good and safe affinity with the skin or hair.

[0007] For example, when the cell of epidermis dies and it becomes a horny layer, intracellular protein decomposes, it becomes amino acid, and it came to be known that this amino acid will function as a moisturization factor of a horny layer. Moreover, it has also turned out that amino acid is acting as a moisturizing component of the cuticle of hair.

[0008] Then, the charge of makeup which blended amino acid came to be developed. JP,8-217656,A is indicating the charge of makeup containing saccharide joint polyamino acid. JP,10-298058,A is indicating the baths containing polyacid nature amino acid. These perceive the moistness of polyamino acid and aim at the moisturizincy effect and the surface deterioration prevention effectiveness of the skin, or skin smooth effectiveness.

[0009] Moreover, JP,2001-34217,A indicates the skin external preparations which blended the amino acid and fermented-soybeans extractives more than a kind, and JP,2000-34219,A is indicating the skin external preparations which blended the mucopolysaccharide and fermented-soybeans extractives more than a kind. In addition to a moisturization operation of amino acid or a mucopolysaccharide, these invention adds the resiliency of fermented-soybeans extractives.

[0010] Fermented-soybeans extractives are the liquid which carried out the ethanol extract of the viscous component of fermented soybeans, and are natural extractives which use gamma-polyglutamic acid as a principal component. Although glutamic acid is also a kind of amino acid, there is a property of giving a feeling of elasticity to the skin by the viscosity nature, and since it is moreover a natural component, it is a very safe charge of makeup.

[0011] Thus, the latest charge of makeup has introduced both a moisturizincy effect and the elasticity effectiveness into the charge of makeup by using polyamino acid and gamma-polyglutamic acid together.

[0012] However, since gamma-polyglutamic acid is a kind of polyamino acid, the conventional charge of makeup which uses together polyamino acid and fermented-soybeans extractives will blend two or more sorts of polyamino acid, and will give both operations of moistness and resiliency to the skin and hair. If the class of polyamino acid is different, it can be understood that the properties also differ, but blending two or more sorts of polyamino acid also becomes the factor which skyrockets a price at the same time it complicates the component of the charge of makeup.

[0013] Therefore, the purpose of this invention makes both operations of moistness and resiliency discover by processing the polyamino acid of a single kind, its component presentation is simple, and, moreover, a price is offering the handy charge of makeup.

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**MEANS**

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[Means for Solving the Problem] Invention of claim 1 is a charge of makeup characterized by blending polyamino acid or the radiation-induced crosslinking object of a polyamino acid salt.  
[0015] Invention of claim 2 is a charge of makeup according to claim 1 said whose polyamino acid is gamma-polyglutamic acid and said whose polyamino acid salt is gamma-polyglutamic acid salt.

[0016] Invention of claim 3 is a charge of makeup according to claim 2 the aforementioned gamma-polyglutamic acid or whose gamma-polyglutamic acid salt is the production object of gamma-polyglutamic acid production bacillus.

[0017] Invention of claim 4 is a charge of makeup according to claim 2 in which the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt has 10 million or more molecular weight.

[0018] Invention of claim 5 is a charge of makeup according to claim 2 whose loadings of the radiation-induced crosslinking object of the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt are 0.01 – 10 % of the weight.

[0019]

[Embodiment of the Invention] As a result of doing wholeheartedly research which gives resiliency like fermented-soybeans extractives to the polyamino acid which has moistness, this invention person used to discover that the radiation-induced crosslinking object acquired by carrying out radiation irradiation of polyamino acid or the polyamino acid salt gains resiliency, and used to complete this invention.

[0020] If radiation-induced crosslinking of gamma-polyglutamic acid or the gamma-polyglutamic acid salt is carried out especially, while moistness will increase rapidly also in polyamino acid as compared with bridge formation before, it discovers discovering free resiliency and the foundation of this invention is built.

[0021] Generally, the structure expression of amino acid is expressed with NH<sub>2</sub>(COOH)-CH-R. The heteropolymer the homopolymer and two or more sorts of amino acid the same amino acid carried out [ amino acid ] the polymerization to the shape of a chain carried out [ the heteropolymer ] the polymerization to the shape of a chain exists in polyamino acid. In order to carry out hydrogen bond of the hydrogen atom H and the oxygen atom O in polyamino acid to water, polyamino acid has the moistness which adsorbs water on a front face. Therefore, it is also the reason the moistness of the polyamino acid which has safety is used as a charge of makeup.

[0022] If radiation irradiation of the polyamino acid which is this chain molecule is carried out, for example, CH<sub>2</sub> in polyamino acid becomes CH- by dehydrogenation, CH- of two polyamino acid will combine with CH-HC, and they will form a bridge formation object. If much polyamino acid constructs a bridge with a radiation, it will become the network structure and much saccate space will be formed in the interior. Of course, crosslinking reaction may arise also in paths other than dehydrogenation.

[0023] Since the bridge formation by the radiation can construct a bridge, without heating polyamino acid, it has the advantage which can form a polyamino acid radiation-induced crosslinking object, with the property of amino acid original left. A radiation-induced crosslinking

reaction is low-temperature crosslinking reaction, and a different point from the crosslinking reaction by heating is the description. Although polyamino acid receives heat conversion with heating, in the radiation-induced crosslinking of this invention, it has the description at the point of not receiving heat conversion.

[0024] As mentioned above, since a polyamino acid radiation-induced crosslinking object has much saccate space inside, it has the capacity which carries out absorption preservation of the water molecule to this saccate space, and can discover bigger water retention ability than polyamino acid according to this operation. It not only raises the moisturization engine performance as a cosmetics material much more, but this water retention ability has the description which makes the skin and a hair front face discover resiliency by water retention to saccate space. Thus, by carrying out radiation-induced crosslinking of the polyamino acid, it became possible to possess increase-izing of moistness, and both of resiliency to coincidence.

[0025] Next, gamma-polyglutamic acid is explained in order to materialize the above description more. gamma-polyglutamic acid is the chain molecule expressed with  $n$  (-NH(COOH) CH-CH<sub>2</sub>-CH<sub>2</sub>-CO-), and Subscript  $n$  gives polymerization degree. The thing which has big molecular weight, especially the thing which has hundreds of thousands - millions of molecular weight are suitable for gamma-polyglutamic acid used as a start raw material, and such molecular weight is decided by said polymerization degree  $n$ .

[0026] That by which gamma-polyglutamic acid concerning this invention was produced by the various manufacture approaches is used. As a process, there are the culture approach by the microorganism, a chemosynthesis method, etc., for example. gamma-polyglutamic acid produced by the microorganism is the quality of a natural product, and is recommended from a viewpoint of safety.

[0027] In microorganism cultivation, although bacilli, such as *Bacillus subtilis* of *Bacillus*, *bacillus anthra cis-\*\* bacillus megger TERIUMU*, and *Bacillus natto*, can be used, F-two to 01 shares of *Bacillus subtilis* are especially suitable in a volume. Molecular weight produces gamma-polyglutamic acid of hundreds of thousands - a-1 million number, and since that molecular weight is comparatively large, this strain can manufacture a bridge formation object efficiently with a radiation.

[0028] gamma-polyglutamic acid which a microorganism produces is eaten more as a principal component of the glutinous substance of fermented soybeans in ancient times -- as -- men and beasts -- it is a harmless natural product and has the big description of having biodegradability. That is, even if this gamma-polyglutamic acid not only has biodegradability, but it eats it accidentally, it is harmless, and it excels in the point of becoming a nutrient conversely. Therefore, it can be called a very safe cosmetics material, without hurting the skin and one's hair, even if used as a charge of makeup.

[0029] gamma-polyglutamic acid which said microorganism produces is gamma-peptide of the shape of a straight chain without ramification, and is the copolymer of L-glutamic acid and D-glutamic acid, i.e., a heteropolymer. gamma-polyglutamic acid of this heteropolymer structure is the optimal thing which can be used for this invention.

[0030] gamma-polyglutamic acid of microorganism production carries out seeding of the microorganism to the liquid medium which mixed necessary nourishment, carries out duration culture at necessary temperature, isolates gamma-polyglutamic acid and is obtained from culture medium. A solid medium may be used in addition to a liquid medium. In this invention, the culture containing gamma-polyglutamic acid which was settled not only from gamma-polyglutamic acid simple substance but from the culture medium itself and culture medium, and was obtained is sufficient.

[0031] The polymer of various structures, such as mixture of the homopolymer of L-glutamic acid, the homopolymer of D-glutamic acid, and both [these] homopolymers, is generated by gamma-polyglutamic acid by which chemosynthesis is carried out. These gamma-polyglutamic acid by which chemosynthesis was carried out can also be used in this invention.

[0032] Moreover, gamma-polyglutamic acid salt used by this invention is generated by neutralization of gamma-polyglutamic acid and a basic compound as a salt. If it stirs making it dissolve in solvents, such as water, at a room temperature, and heating gamma-polyglutamic acid

and a basic compound will be generated efficiently. As a basic compound, the hydroxide of alkali metal or alkaline earth metal, for example, a sodium hydroxide, a potassium hydroxide, a magnesium hydroxide, a calcium hydroxide, a barium hydroxide, etc. have the basic compound of organic nature, such as ammonia and an amine.

[0033] In the reaction condition of gamma-polyglutamic acid and a basic compound, whenever [stoving temperature] has desirable 5-100 degrees C. If a reaction becomes slow and exceeds 100 degrees C, the water which is a kind of a solvent may boil below 5 degrees C, and a reaction may not be stabilized at them. Moreover, the range of pH of acescence - weak base nature is desirable, and especially pH has the desirable range of 5-10. Moreover, stoichiometric reacting weight without excess and deficiency is suitable for the daily dose of gamma-polyglutamic acid and a basic compound.

[0034] That from which molecular weight is distributed over hundreds of thousands - a-1 million number is suitable for gamma-polyglutamic acid or gamma-polyglutamic acid salt used by this invention, and in being microorganism production, it distributes the molecular weight within the limits of it. What carried out the polymerization to hundreds of thousands or more also in the case of chemosynthesis is suitable.

[0035] In this invention, the aforementioned gamma-polyglutamic acid or gamma-polyglutamic acid salt is made to construct a bridge with a radiation, and molecular weight generates 10 million or more bridge formation objects.

[0036] If a radiation is irradiated at this gamma-polyglutamic acid, CH<sub>2</sub> becomes CH- by dehydrogenation, the straight chain of two gamma-polyglutamic acid joins together through CH-HC, and it is thought that a bridge is constructed like 2 (-NH(COOH) CH-CH-CH<sub>2</sub>-CO-). If this degree of cross linking becomes still larger, a radiation-induced crosslinking object with big molecular weight will be generated like [(-NH(COOH) CH-CH-CH<sub>2</sub>-CO-) n] m. Here, m shows a degree of cross linking and gives the number of the straight chain of gamma-polyglutamic acid by which bridge formation connection is carried out.

[0037] By enlarging a degree of cross linking m, molecular weight of gamma-polyglutamic acid radiation-induced crosslinking object is made or more into 10 million. Since gamma-polyglutamic acid is a polypeptide chain, the network structure by which much saccate space was formed in the interior of connection of -CH-HC- is formed.

[0038] This invention is discovered and made [having polyamino acid and the water-absorption-power force also in it in which the radiation-induced crosslinking object of gamma-polyglutamic acid is very big, and]. The water absorption reaches also about 1000 times, and it increases, so that it does not become as compared with the water absorption of gamma-polyglutamic acid in front of radiation irradiation. If increase-ization of this water absorption is put in another way -- the moisturization engine performance --- \*\*\*\* --- it is-izing and increase-ization of resiliency ability is brought to coincidence. It is again said to the absorptivity of gamma-polyglutamic acid being only the hydration on the front face of a molecule that the absorptivity of gamma-polyglutamic acid radiation-induced crosslinking object is water absorption to the internal saccate space by the network structure.

[0039] Since saccate space will become small if it passes over a degree of cross linking in slight height, water holding capacity declines and moistness and resiliency also decline. Therefore, it becomes possible by adjusting a degree of cross linking appropriately to optimize moistness and resiliency.

[0040] Since the water holding capacity of the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt shuts up into water the particle of the makeup material which protects the skin, it can protect the skin and hair over a long period of time, and can make the manifestation period of the makeup effectiveness it not only to hold moisture, but extend.

[0041] Like the above-mentioned, it is the description to use a radiation for making gamma-polyglutamic acid construct a bridge in this invention. In making a bridge construct according to thermal reaction, an elevated temperature is needed and, for this reason, gamma-polyglutamic acid as a raw material or gamma-polyglutamic acid salt tends to receive thermal denaturation. If radiation-induced crosslinking is used, since a bridge can be constructed at low temperature,

bridge formation can be realized without deteriorating gamma-polyglutamic acid. Therefore, gamma-polyglutamic acid bridge formation object which does not contain a denaturation object can be acquired by radiation-induced crosslinking.

[0042] Especially gamma-polyglutamic acid of microorganism production is a kind of a polypeptide, and it is difficult to adopt heating bridge formation, judging from the weak thermal one of amino acid. Considering that the viscous matter of fermented soybeans is gamma-polyglutamic acid, probably, the situation of the thermal denaturation at the time of heating fermented soybeans is known well. Therefore, in this invention, in order to realize low-temperature bridge formation, it has the description at the point of using radiation-induced crosslinking.

[0043] It can carry out radiation irradiation of the culture medium, the culture, etc. obtained by microbial cultivation, and it not only carries out radiation irradiation of the simple substance of gamma-polyglutamic acid or gamma-polyglutamic acid salt, but can acquire the radiation-induced crosslinking object of gamma-polyglutamic acid or gamma-polyglutamic acid salt.

[0044] As a radiation for bridge formation, alpha rays, beta rays, a gamma ray, an X-ray, an electron ray, a neutron beam, a meson line, an ionic line, etc. can be used. Also in this, a gamma ray, an X-ray, and an electron ray are suitable from good [ of operability ]. Both X-ray tube or non-bulb type can use an X-ray, and the synchrotron orbital radiation emitted from the electronic ring which has spread in recent years can also use it. An electron ray can use well-known electron-beam-irradiation equipment according to beam energy.

[0045] The gamma ray is excellent in the point that the radiation source can be used. Although there are the cobalt 60, a strontium 90, a zirconium 95, cesium 137, a cerium 141, and ruthenium 177 grade as a gamma ray source, the cobalt 60 from a viewpoint and cesium 137 of a half-life or energy are suitable.

[0046] In this invention, molecular weight generates 10 million or more gamma-polyglutamic acid radiation-induced crosslinking objects or gamma-polyglutamic acid salt radiation-induced crosslinking object by carrying out radiation-induced crosslinking of gamma-polyglutamic acid or the gamma-polyglutamic acid salt. If a bridge is constructed or more over 10 million in molecular weight, the absorptivity ability of gamma-polyglutamic acid bridge formation object will increase rapidly, and the moisturization engine performance and resiliency ability will improve as a charge of makeup.

[0047] In order to construct a bridge over 10 million or more molecular weight in gamma-polyglutamic acid or gamma-polyglutamic acid salt, the radiation irradiation of 1-500kGy is required for gamma-polyglutamic acid raw material at an absorbed dose, by 1 or less kGy, since bridge formation will advance too much if bridge formation does not advance easily and 500kG (ies) are exceeded, the building envelope formed of the network structure of a bridge formation object becomes small, and water absorbing power comes to decline conversely. As an absorbed dose from a viewpoint of cross-linking and absorptivity, 5-100kGy is still more suitable.

[0048] Generally, although gamma-polyglutamic acid salt is dissolved in water, it is known that gamma-polyglutamic acid is insolubility at water. However, when radiation-induced crosslinking was performed also to any of gamma-polyglutamic acid and gamma-polyglutamic acid salt, it was discovered that reforming is carried out so that the front face of a radiation-induced crosslinking object may have compatibility to water and water organic solvents, such as water alcohol and a water acetone.

[0049] This invention was also made paying attention to the property of the surface treatment of gamma-polyglutamic acid by radiation-induced crosslinking, and gamma-polyglutamic acid salt radiation-induced crosslinking object. That is, both gamma-polyglutamic acid and gamma-polyglutamic acid salt come to have a hydrophilic property by becoming a radiation-induced crosslinking object.

[0050] It means that gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object dissolve to a lot of [ this property ] water. However, the intermediate state to the dissolution also means absorbing water water and holding the gel state and a sol condition. According to the experiment of this invention person, with the water absorption over pure water, it turns out that it will shift to a sol condition if about 1000 times hold the gel state

and the amount of pure water is made [ more ] than it, and it changes to a solution gradually. Therefore, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object have the capacity for a compounding ratio with water to be able to adjust the material gestalt of cosmetics free.

[0051] gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object also have alcoholic content capacity by the hydrophilic property, for example, if added by 0 – 50% of native alcoholic water solution, it can mix with equalization and they can be gelled.

[0052] Moreover, it can mix with gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object with many hydrophilic matter underwater. For example, it can mix and gel to the water solution and homogeneity of 0 – 50% of glycerol, butanediol, or polyethyleneimine.

[0053] Furthermore, it can mix with gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object with many hydrophobic matter in an alcoholic water solution. For example, it can mix and gel in the diol mold 700 and the diol mold 3000 of a polypropylene glycol to the water solution and homogeneity which added alcohol. The same property also as a liquid paraffin is shown.

[0054] Therefore, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object can mix with other charge materials of makeup and homogeneity which were chosen appropriately, and can form the charge of makeup made into the purpose. It can follow, for example, gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object can be used as a material of various kinds of cosmetics, such as makeup products, such as hair treatment products, such as skin care products, such as a milky lotion and an essence, and hair rinse hair treatment, and foundation, and a lip stick.

[0055] Although 0.01 – 10% of the weight of the range is suitable for the loadings of gamma-polyglutamic acid and gamma-polyglutamic acid salt radiation-induced crosslinking object, since they differ according to the cosmetics made into the purpose, they are not limited to this numeric value.

[0056] The property of gamma-polyglutamic acid mentioned above and gamma-polyglutamic acid salt radiation-induced crosslinking object is applicable also like the polyamino acid as a charge of makeup and the polyamino acid salt radiation-induced crosslinking object which are a superordinate concept.

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## EXAMPLE

[Example] As a [manufacture of radiation bridge formation object of example 1:gamma-polyglutamic acid] gamma-polyglutamic acid production bacillus, *Bacillus subtilis* F-2-01 was chosen. In order to mass-produce, the liquid medium has been arranged in the container of 3 several 100m. The medium composition was constituted as follows.

グルコース	0. 5重量%
L-グルタミン酸	8. 0重量%
ペプトン	0. 7重量%
ウレア	0. 68重量%
NaNO <sub>3</sub>	0. 5重量%
KH <sub>2</sub> PO <sub>4</sub>	0. 24重量%
精製水	残量

[0058] the inside of this liquid medium -- said strain -- inoculation -- carrying out -- pH -- 7.5 -- adjusting -- a top -- 37-degree C constant temperature -- it held in the condition. If culture is continued for six days, carrying out aeration stirring, gamma-polyglutamic acid and its salts will be accumulated into culture medium. Centrifugal separation of the culture medium was carried out, the fungus body was separated from culture medium, and the aforementioned gamma-polyglutamic acid was isolated further.

[0059] Although it depended for the volume of gamma-polyglutamic acid also on the culture condition, it turned out that it reaches into culture medium 5-50 (g/L), and it was proved that industrial mass production method of gamma-polyglutamic acid is possible. Moreover, it turned out that the molecular weight of produced gamma-polyglutamic acid is distributed over 500,000-2 million. Here, an acid, salts, or those mixture are named gamma-polyglutamic acid generically.

[0060] 20kG(ies) (2Mrad) exposure of the gamma ray was carried out according to the cobalt 60 line source at the 5-% of the weight water solution of these gamma-polyglutamic acid, and gamma-polyglutamic acid radiation-induced crosslinking object was generated. The water solution was gelled by this radiation irradiation, and the molecular weight of gamma-polyglutamic acid radiation-induced crosslinking object was presumed to be about 15 million. this gel matter -- dehydrating -- gamma-polyglutamic acid radiation-induced crosslinking object -- \*\*\*\*\*. This powder was white. Said gel matter and desiccation powder can be used as the charge raw material of makeup of this invention. This desiccation powder was used for all future examples.

[0061] [example 2: The amount of gelation] radiation irradiation of the water solution of polypropylene 700 obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with polypropylene 700, and polypropylene 700 was gelled. A result is shown in Table 1.

[0062]

## &lt;表1&gt; PGA 1 % を添加したゲル (単位は重量部)

<ポリマー量>	<純水>	<ゲル化状況>
2 0	8 0	不透明均一ゲル
3 0	7 0	不透明均一ゲル
4 0	6 0	不均一ゲル
5 0	5 0	不均一ゲル

[0063] As shown in Table 1, when the amount of polypropylene became large, it was hard coming to dissolve and uneven gel was done. However, when the amount of polypropylene became small, it turned out that it becomes opaque gel although equalization is carried out, and it is not dissolving completely.

[0064] [example 3: Ethyl alcohol was added in the water solution of the gelation] example 2 of the alcoholic water solution of polypropylene 700, and gelation was tried. The amount of radiation irradiation obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, ethyl alcohol was mixed with polypropylene 700 and pure water, and polypropylene 700 was gelled. A result is shown in Table 2.

[0065]

Gel which added <Table 2> PGA1% (a unit is the weight section)

The <amount of polypropylene> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 50

Transparence homogeneity gel 30 70 50 Transparence homogeneity gel 40 60 50 Transparence homogeneity gel 50 50 50 Transparence homogeneity gel [0066] As shown in Table 2, when only 50 weight sections added ethyl alcohol, regardless of the size of the amount of polypropylene, it dissolved in homogeneity and transparent homogeneity gel was obtained. Therefore, it turned out that the gelation by PGA improves greatly by adding alcohol.

[0067] [example 4: The amount of gelation] radiation irradiation of the water solution of polypropylene 3000 obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with polypropylene 3000, and polypropylene 3000 was gelled. A result is shown in Table 3.

[0068]

## &lt;表3&gt; PGA 1 % を添加したゲル (単位は重量部)

<ポリマー量>	<純水>	<ゲル化状況>
2 0	8 0	不均一ゲル
3 0	7 0	不均一ゲル
4 0	6 0	不均一ゲル
5 0	5 0	不均一ゲル

[0069] As shown in Table 3, polypropylene 3000 was not mixed with water regardless of the size of the amount, but even if gelled, it was able to do only uneven gel. However, as for some, compatibility was accepted.

[0070] [example 5: Ethyl alcohol was added in the water solution of the gelation] example 4 of the alcoholic water solution of polypropylene 3000, and gelation was tried. The amount of radiation irradiation obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, ethyl alcohol was mixed with polypropylene 300 and pure water, and polypropylene 3000 was gelled. A result is shown in Table 4.

[0071]

Gel which added <Table 4> PGA1% (a unit is the weight section)

The <amount of polypropylene> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 40

Opaque gel 30 70 40 Opaque gel 40 60 40 Opaque gel 50 50 40 Opaque gel [0072] As shown in Table 4, when only 40 weight sections added ethyl alcohol, regardless of the size of the amount of polypropylene, compatibility came to be looked at by the whole and opaque gel was obtained.

When alcohol was added to the water solution, some improvements were realizable, but when homogenizing this further, it also turned out that a uniform sol can be created.

[0073] [example 6: The amount of gelation] radiation irradiation of the water solution of a liquid paraffin obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, pure water was mixed with the liquid paraffin, and the liquid paraffin was gelled. A result is shown in Table 5.

[0074]

<表5> PGA 1%を添加したゲル (単位は重量部)

<流動パラフィン量> <純水> <ゲル化状況>

2 0	8 0	ゲルとパラフィンは分離
3 0	7 0	ゲルとパラフィンは分離
4 0	6 0	ゲルとパラフィンは分離
5 0	5 0	ゲルとパラフィンは分離

[0075] As shown in Table 5, the liquid paraffin was not mixed with water but the liquid paraffin also separated completely the gel generated by addition of PGA. Therefore, gelation of a liquid paraffin was not completed.

[0076] [example 7: The amount of gelation] radiation irradiation of the alcoholic water solution of a liquid paraffin obtained the powder of gamma-polyglutamic acid radiation-induced crosslinking object of 20kG(ies). This powder (PGA) was added 1% of the weight, the ethyl alcohol 50 weight section was mixed with a liquid paraffin and pure water, and the liquid paraffin was gelled. A result is shown in Table 6.

[0077]

Gel which added <Table 6> PGA1% (a unit is the weight section)

The <amount of liquid paraffins> <Pure water> <Ethyl alcohol> <Gelation situation> 20 80 50

Affinitive ununiformity gel 30 70 50 Affinitive ununiformity gel 40 60 50 Affinitive ununiformity gel 50 50 50 Affinitive ununiformity gel [0078] If ethyl alcohol is added as shown in Table 6, although a liquid paraffin and water are uneven, it will mix and gel. In other words, it turned out that paraffin and ununiformity gel with compatibility are done. Therefore, where alcohol is added, when gelling by PGA, it turned out that more effective gelation can be attained.

[0079] The homogeneity gel in which the charge component of makeup carried out the distributed dissolution at homogeneity can be formed by blending the radiation-induced crosslinking object of gamma-polyglutamic acid concerning this invention, or gamma-polyglutamic acid salt with a water solution or a fortification-of-alcohol water solution with other charge components of makeup so that the above example may show. Therefore, it can use as a middle article which can use this homogeneity gel or sol as cosmetics, and results in cosmetics.

[0080] The charge of makeup concerning this invention is not limited to the above-mentioned operation gestalt and the above-mentioned example, and it does not have that it is what includes the various modifications in the range which does not deviate from the technical thought of this invention, a design change, etc. within the technical limits also until it says.

[Translation done.]

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